5. Maino Ranch Project

5.1 Introduction

The Mainos' interests and land ethics, and overall erosion control goals, led to a partnership with the Natural Resources Conservation Service (U.S. Department of Agriculture). An agreement was made that included cost sharing for installation of new fencing and development of water resources. These modifications were made for the purpose of controlling cattle movement through smaller pastures, provided with water, in intensive grazing rotation/rest system. The new strategy was based on managing the cattle and the land together in order to meet the objectives: increase biodiversity and plant vigor; maximize forage quality and production on a sustained or increasing basis throughout the growing season; decrease bare ground and erosion; keep physical handling stress of the animals to a minimum; and maintain integrity of land for watershed protection and wildlife. Cal Poly and the Regional Board began monitoring stream channel health and water quality following BMP implementation in 1994 in order to document changes and evaluate trends. The monitoring was completed in 2000.

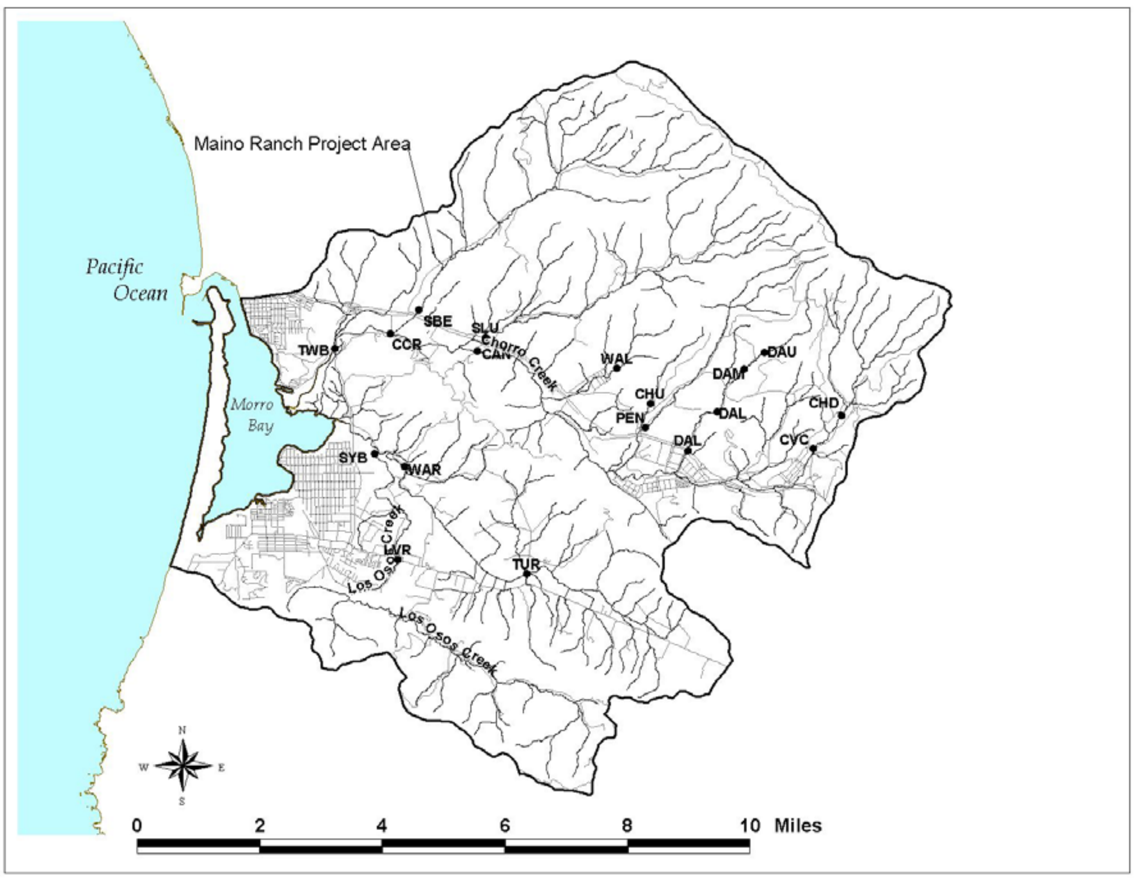

Figure 5.1 Maino Ranch Project Location.

5.2 Methods

Grazing History

A very important factor affecting range data collected during this study is grazing history. Mr. Maino kept meticulous records of his grazing rotation over the past seven years. The records indicate animal days/acre (ADA) in each pasture over the course of the study (Table 5.1). "Animal day" is an estimate of the amount of dry forage (biomass) consumed based on 3 % body weight of the grazing animal. For cattle the estimate is based on the body weight of an 800-pound steer and is approximately 24 lbs/day. Available biomass in a pasture can be calculated by multiplying the number of acres in a pasture by the number of ADA and the estimated consumption of the animal on a daily basis. Cow/calf consumption is also based on body weight of a steer, and will be estimated as 24 lbs of dry matter per day.

Seasonal Vegetation Monitoring

Cal Poly project staff established permanent range and stream transects in 1993 (Fig. 5.1). Data were collected from fall 1993 through spring 2001. Vegetation monitoring was conducted in the spring and in the fall. Spring season monitoring occurred after the rainy season and during the flowering and seed set life stage of the majority of rangeland vegetation. Generally, this was in the interval between May and July, inclusive. Spring season monitoring measured species diversity, plant height, nonfoliar cover, and biomass.

Fall season vegetation monitoring occurred prior to and during the rainy season, generally between November and March. Fall season monitoring surveyed the vegetation to determine the percentages of grasses and forbs, plant height, nonfoliar cover, and biomass. In the fall, vegetative cover was classified as grasses, forbs and other with shrubs, trees, woody vines, sedges and rushes being classified as other. Genus and species were not identified during fall season monitoring since most rangeland plants do not have flowers or seeds at this time.

The rangeland sampling at the Maino Ranch initially was done in both Fall and Spring, like the paired watersheds. Later, to avoid disturbing the cattle, the team conducted their evaluations once per year rather than twice per year.

Stream Channel Monitoring

Cal Poly project staff conducted stream channel monitoring in spring and fall in the early years of the project, and only in the spring in later years. Stream profiles usually correspond to range transects and are located in the streams which are intersected by range transects. Stream transect SM1 is located in the pasture just north of the pasture containing RM1 (Fig. 5.1). Transect SM2 encompasses the reach of gully intersected by RM1. Stream transect SM3 is located on the stream intersected by RM4, and SM4 corresponds to RM5. Stream transect SM5 is twice as long as other stream transects.

Transect SM5 is located in the reach intersected by RM6. Transect SM6 corresponds to RM7/8.

Stream transects were set up with the "A" profile located at the upstream end of the reach. The left stream bank (LSB) is on the left side of the channel looking downstream and zero is always located at the top of the upper bank on the LSB. Correspondingly, the right stream bank (RSB) is located on the right hand side of the channel looking downstream. The permanent stream cross sectional transects were marked with rebar extending several feet into the ground and marked at the surface with colored plastic feathers. These feathers need to be replaced nearly annually due to fading and being pulled out by cows. It became common practice to pile rocks (when available) over the tassels to help in marking the permanent cross sectional starting and ending points. Stream cross-sectional profiles were constructed using a tape marked in feet and tenths of feet stretched across the permanent transect. A survey rod and automatic level were used to document the depth of the stream from upper bank to upper bank.

Stream Channel Stability Evaluation

Cal Poly project staff began the use of an overall subjective stream health form in 1995. The Pfankuch stream stability rating system (Pfankuch, 1978) was used to evaluate the entire reach included in the study area (from A to C). When interpreting Pfankuch stream stability scores, higher scores indicate a decrease in health of the stream for the parameter evaluated. The scores for each parameter are added together to obtain a total score which is categorized and labeled within a range from low poor to high good with midrange values falling out between low and high fair.

The use of the Pfankuch method was somewhat frustrating for monitors who felt it was too subjective, and many parts of the Pfankuch evaluation form are not applicable to xeric climate clay bottom streams predominant in the Morro Bay watershed. The method was designed for use in mountainous perennial streams. Due to the differences in our local streams in comparison with perennial cobbly streams, scores on Pfankuch Stream Stability vary inconsistently depending on interpretations of the monitor. This is also discussed in Chapter 9, Lesson's Learned.

As with the paired watersheds, in order to document conditions through time, photographs of the transect areas were taken each monitoring season, and archived.

Water Quality Monitoring

Regional Board project staff conducted water quality monitoring at a small drainage on the ranch. This included year-round grab sampling. The samples were tested for suspended sediment, turbidity, pH, dissolved oxygen, temperature, and conductivity. The area was once farmed and is now included in the managed grazing system.

Table 5.1. Grazing history, Maino Ranch.
Maino ranch grazing records for animal days/acre by month and year for each pasture containing a transect.

Pasture	**D1**	**D2**	**D4**	**D6**	**D10**	**H1**	**H2**	**H6**
Acres	80	105	55	60	15	40	70	85
Year				animal days/acre (month)				
1994	10 (Jan)	9 (Jan)	6 (Feb)	5 (Feb)	10 (Jan - Feb)		7 (Mar)	4 (Mar)
	2 (Mar)	3 (Mar)	3 (March)	3 (April)	21 (April - May)		5 (May)	8 (May)
		13 (May)		5 (May)	41 (May)		45* (Nov - Dec)	18 (Oct)
	5.	4 (June)		17 (Sept - Oct)	5 (Sept)			
1995	11 (Jan)	3 (Jan)	18 (Dec - Jan)	5 (Dec)	18 (Jan - Feb)	9 (Feb)	17* (Dec)	5 (Jan)
	5 (Mar)	5 (Feb - Mar)	6 (Feb)	3 (Feb)	5 (Jul)	5 (Mar)	2 (Feb)	8 (Mar)
	6 (Apr)	7 (Apr)	3 (Apr)	6 (Mar(		5 (Apr)	6 (Mar)	8 (Apr)
	12 (Sep)	24 (Jun - Aug)	8 (Jun)	9 (May)		5 (Jul)	8 (May)	21 (Oct - Nov)
			26 (Aug - Sep)	8 (Jul)			24* (Nov)	
				5 (Sep - Oct)				
1996	4 (Mar)	30* (Dec - Jan)	3 (Mar)	8 (Jan)	64 (Dec - Feb)	4 (Mar)	11* (Dec)	4 (Mar)
	4 (April)	3 (Mar)	3 (Apr)	5 (Feb)		4 (Apr)	4 (Feb)	4 (Apr)
	13 (Jun)	3 (Apr)	30 (Jul - Aug)	3 (Mar)		# ? (Sept - Oct)	4 (Apr)	30 (Oct)
		20 (Aug)		8 (May)			16 (Jul)	
		6 (Sep - Oct)					26* (Oct - Nov)	
1997	8 (Dec)	4 (Dec)	5 (Dec)	5 (Dec)	Horses	3 (Feb)	5 (Jan)	21 (Dec)
	4 (Feb)	2 (Feb)	10 (Jan)	1 (Jan)		4 (Mar)	5 (Mar)	14 (Jan)
	5 (Mar)	6 (Mar)	4 (Mar)	1 (Feb)		1 (Apr)	5 (Apr)	13 (Feb)
	19 (May)	33 (Apr - May)	24 (Aug - Sep)	7 (Mar)		2 (May)	22 (May)	20 (Mar)
				10 (Sep - Oct)		8 (Jun)	15* (Nov)	15* (Nov)
						10 (Oct)		
1998	13* (Dec)	4 (Jan)	3 (Jan)	5 (Jan)	Horses	4 (Mar)	25 (Dec)	11* (Dec)
	2 (Jan)	5 (Feb)	3 (Feb)	4 (Feb)		5 (Apr)	5 (Jan)	2 (Jan)
	4 (Feb)	5 (Apr)		3 (Mar)		10 (Aug - Sep)	5 (Feb)	4 (Mar)
	7 (Apr)	18 (Jun)		3 (Apr)			5 (Mar)	5 (Apr)
	22 (Jun - Jul)	12 (Jul - Aug)		3 (May)			7 (Apr)	15 (Jun)
				3 (Jun)			21 (Aug)	11 (Nov)
				10 (Sep - Oct)				
1999	7 (Dec)	4 (Jan)	17 (Jan)	15* (Dec)	Horses	4 (Dec)	15* (Dec)	4 (Jan)
	4 (Feb)	2 (Feb)	3 (Feb)	3 (Feb)		4 (Jan)	4 (Feb)	2 (Feb)
	5 (Apr)	3 (Mar)	3 (Mar)	3 (Mar)		5 (Mar)	4 (Apr)	3 (Mar)
	5 (May)	5 (Apr)	7 (Apr)	3 (Apr)		5 (Apr)	4 (Mar)	8 (Apr)
	19 (Sep)	5 (Sep)		3 (Sep)		4 (May)	10 (May)	12 (Jun)
				7* (Nov)		26 (Jun)	30* (Nov)	18 (Oct)
2000	4 (Jan)	17* (Dec)	14 (Jan)	15* (Dec)	Horses	4 (Feb)	15* (Dec)	2 (Feb)
	2 (Feb)	3 (Feb)	3 (Feb)	3 (Feb)		4 (Mar)	2 (Feb)	6 (Mar)
	2 (Mar)	3 (Mar)	6 (Mar)	6 (Apr)		4 (Apr)	6 (Mar)	6 (Jun)
	2 (Apr)	4 (Apr)					13 (Apr)	

* with Hay (supplemental feeding), December values are from previous calendar year.

5.3 Results and Discussion

Spring Foliar Cover

While annual grasses were dominant (with respect to % foliar cover) on most transects, the results of spring sampling seemed to be largely a function of sampling time. Percent cover of annual grasses increased when sampling occurred in June and July rather than May. Annual grasses on most transects ranged between 60% and 80%. RM3 consistently had more wildflowers and perennial grasses than other transects; the maximum value documented for annual grasses was 63%. For most transects, percent cover of forbs was greater when sampling occurred in May and the majority of samples had percent cover of forbs ranging from 5% (the maximum on RM1) to 20%. The artifact of the varying sampling times makes it difficult to tell if, overall, species diversity is increasing in response to BMPs (Fig. 5.2).

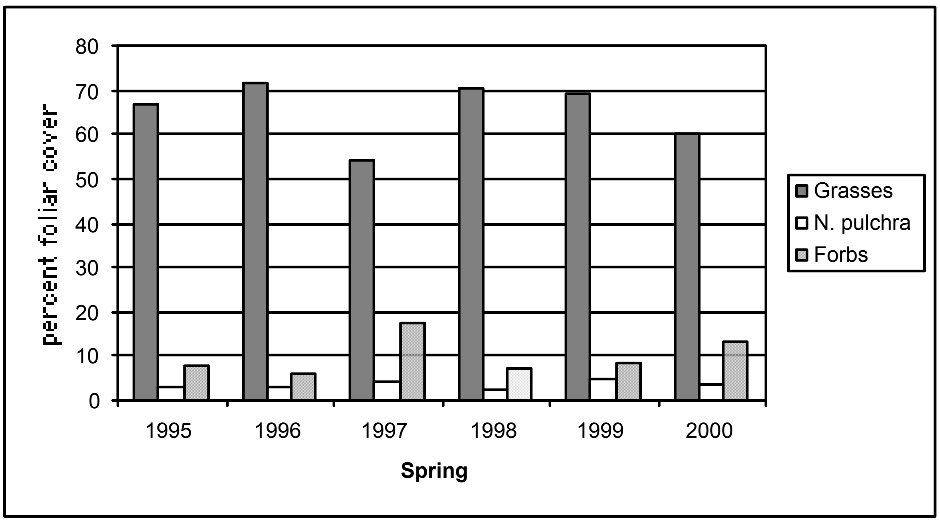

Figure 5.1. Spring foliar cover summary: annual grasses, purple needlegrass (*Nassella pulchra*), and forbs on Maino Ranch. Data are averages for entire ranch.

While it was not the intent of the initial project to evaluate the BMPs, and rather an opportunity to evaluate trends on a privately-owned, BMP implementation site, the lack of a control watershed or pre-BMP monitoring make it difficult to identify or document vegetation trends associated with BMPs. This is also discussed in Chapter 9, Lesson's Learned.

Species diversity was lowest on RM1 and RM5, which had the least amount of species documented. RM1 is recovering from historical cropping practices and is the site of a gully with headcutting (SM2). RM5 may be in a high traffic area, since it is near several gates leading to the barn and to pastures in all directions. In addition, RM5 may have lower diversity because of different grazing practices in pasture D10. This pasture does not have the same rotation as other pastures and is often used for a few horses or one bull and for calving cows during the winter months.

General vegetative species trends were:

- annual grasses remained the dominant vegetation overall
- a decrease in percent cover of *Lolium multiflorum* (annual ryegrass)
- increases in *Brachypodium distachyon* (brachypodium or false brome) and *Bromus hordeaceus* (soft chess brome)
- the appearance of *Vulpia myuros* (rattail fescue) in later years when it had not been previously documented
- decrease in *Phalaris tuberosa* (harding grass) in the upper ranch (RM1 and RM2)
- new appearance of *Phalaris tuberosa* (harding grass) on RM7/8

None of the vegetative trends were statistically significant.

Nassella pulchra (purple needlegrass) did not show a clear increase or decline on most transects throughout the study except for RM3. On RM3, percent cover of *Nassella pulchra* (purple needlegrass) appeared to be increasing and the range was much higher (10 – 18 % cover) than on other transects. Percent cover of forbs for each species was so small that increasing or decreasing trends were not documented on RM3. Wildflowers including *Escholzia californica* (California poppy), *Lasthenia californica* (goldfields), *Layia platyglossa* (tidy tips) and Ranuculus californica (California buttercup) were more abundant on RM3. In fact *Lasthenia californica* (goldfields) and *Layia platyglossa* (tidy tips) were not found on any other transects.

Spring Nonfoliar Cover and Biomass

Bare ground increased somewhat in the latter years of the project (Fig. 5.2), although the ratio of bare ground to nonpersistent litter rarely exceeded 2:1. Nonpersistent litter decreased from the beginning of the project, but appeared to be increasing again in the latter years. Rangeland monitors usually observed a much greater percent cover of bare ground in the stream channel than on the uplands.

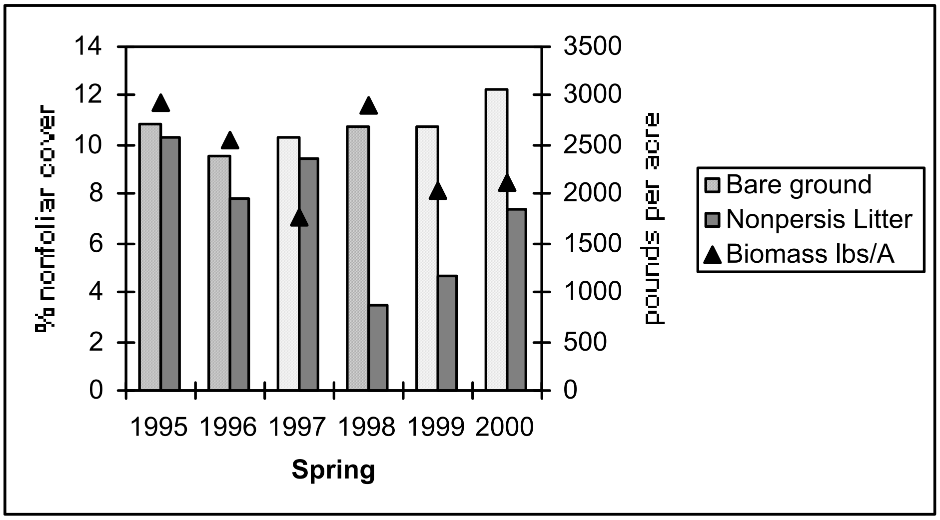

Figure 5.2. Spring nonfoliar cover and biomass, Maino Ranch.

Fall Foliar Cover

Fall foliar cover was also predominantly grasses (Fig. 5.3). However, the percent cover of forbs appeared to increase on most transects in later years. The increase in percent cover of forbs during later years may have been due to sample time, because the later years were sampled during February and March when water in a northern hemisphere xeric climate is most abundant, and juvenile annual forbs are beginning their life cycle. In contrast, sampling during the late fall often occurred too early for germination of new vegetation. Thus, as in the spring sampling, results are largely an artifact of varying sampling times. Sample times were shifted from the original plan depending on data collectors' accessibility to the ranch.

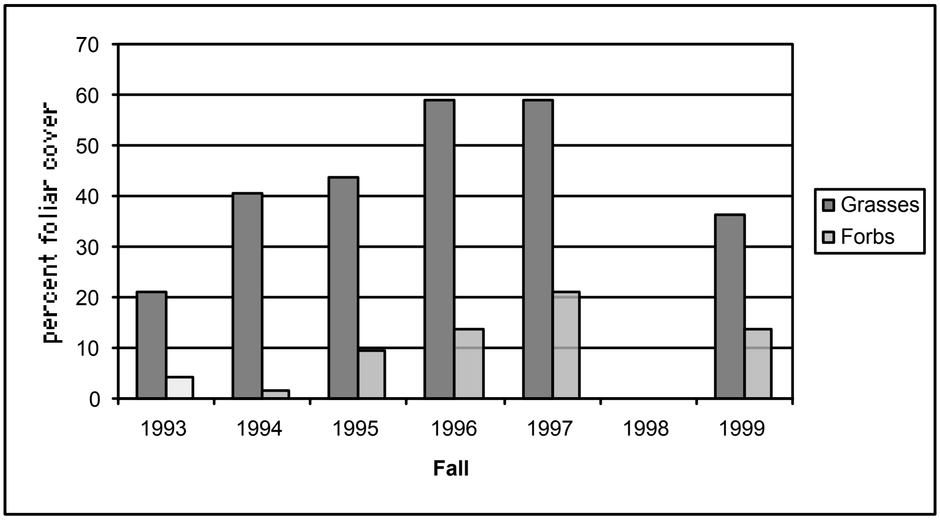

Figure 5.3. Fall foliar cover, Maino Ranch, 1993 through 1999 (no data were collected during fall 1998).

Fall Nonfoliar Cover

Bare ground fluctuated somewhat since BMP implementation (Fig. 5.4). Nonpersistent litter has decreased since BMP implementation. The results of fall percent nonfoliar cover monitoring also appear to have been affected by sample time. Increases in bare ground and decreases in nonpersistent litter in later years correspond to sampling in February and March, when decomposition of nonpersistent litter is aided by increased moisture from seasonal rainfall.

Fall Season Biomass

Fall season biomass values may have been influenced primarily by sampling time. Sampling in January through March generally documented juvenile growth, low in cellulose and high in water with most plant heights between one and four inches (4 – 10 cm). Sampling which occurred in November likely documented a predominance of standing RDM, high in cellulose, low in water, and often having heights between three and six inches (8–15 cm). Fall biomass values decreased during the period 1996 through 1999.

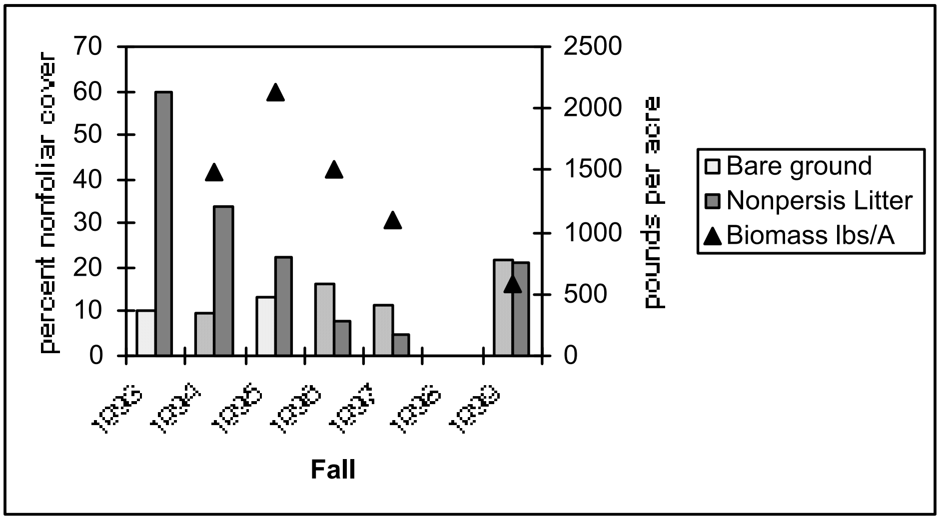

Figure 5.4. Fall nonfoliar cover and biomass, Maino Ranch.

Based on regression analyses, few of the vegetation and nonfoliar trends could be readily explained by seasonal rainfall totals. Correlation of percent annual grasses, purple needlegrass, and forbs yielded R^2 values of 0.07, 0.46, and 0.08, respectively (graphs not shown). Values of R^2 for correlation of spring bare ground and fall bare ground with annual rainfall were 0.07 and 0.12, respectively. Spring biomass, and fall biomass show better correlation with rainfall, with R^2 of 0.69 and 0.52, respectively (Fig. 5.5).

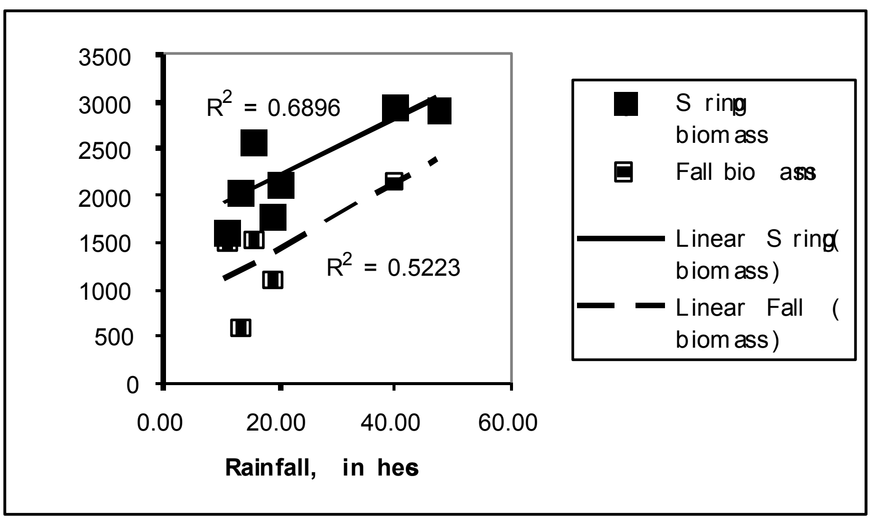

Figure 5.5. Linear regression of spring and fall biomass with total rain-year rainfall.

Stream Channel Stability

Overall, scores for stream stability on each transect did not change dramatically throughout the monitoring period. Most scores varied within a range of three ratings on each reach, and all streams fell between the categories of low fair to high good. SM1 changed from high good in 1995 to med. good in 2000. Year 1995 was a very high rainfall year and dense vegetation probably influenced the score, whereas in 1996 the rating fell to high fair before improving for the rest of the sample years analyzed. SM2 had ratings of low fair in 1995 and in 2000, only deviating from this pattern in Sp/97 when a rating of medium fair was given. SM2 was the site where headcutting of a gully in the channel bottom was increasing and moving upstream. SM3 ranged from low good in 1995 to high fair in 2000. The low good rating in 1995 may again have been influenced by dense vegetation due to high rainfall, which tends to reduce visual exposure of slumps and cutting. SM4 was rated as high fair in 1995 and improved to a rating of low good in 2000, although alternate fluctuation between these ratings did not prove a clear increasing trend. SM5 fluctuated within the range from low good to high fair but the first documentation in 1996 was low good and the last documentation in 2000 was low good. SM6 was rated as low good in 1995 and 2000, but had ratings of high fair in 1996 and 1997 and a rating of med. fair in 1999.

The subjectivity of this form and turnover of monitors may have increased variation among ratings. (See Chapter 9). As a result, subtle improvements were difficult to document. In addition, the Pfankuch channel bottom categories were designed for perennial, rocky-bottom streams and not designed to categorize clay bottom streams receiving only winter precipitation. The channel bottom interpretations evolved to include vegetative cover in the percent stable materials category since dense vegetative cover likely reduces detachment and movement of silts and clays.

Stream Profiles

Most stream profiles did not change dramatically. Streambanks typically showed very small areas of erosion, mainly by mass wasting, on the upper banks, and minor deposition on the lower banks and channel bottoms (Fig. 5.6).

Photographs of stream transect areas pre- and post-BMP implementation were archived. Comparisons reveal that some features have improved, but overall, there has been little change during the monitoring period, possibly due to the fact that monitoring began post-BMP, and the ranch is already in good condition as has been managed well (Fig. 5.7)

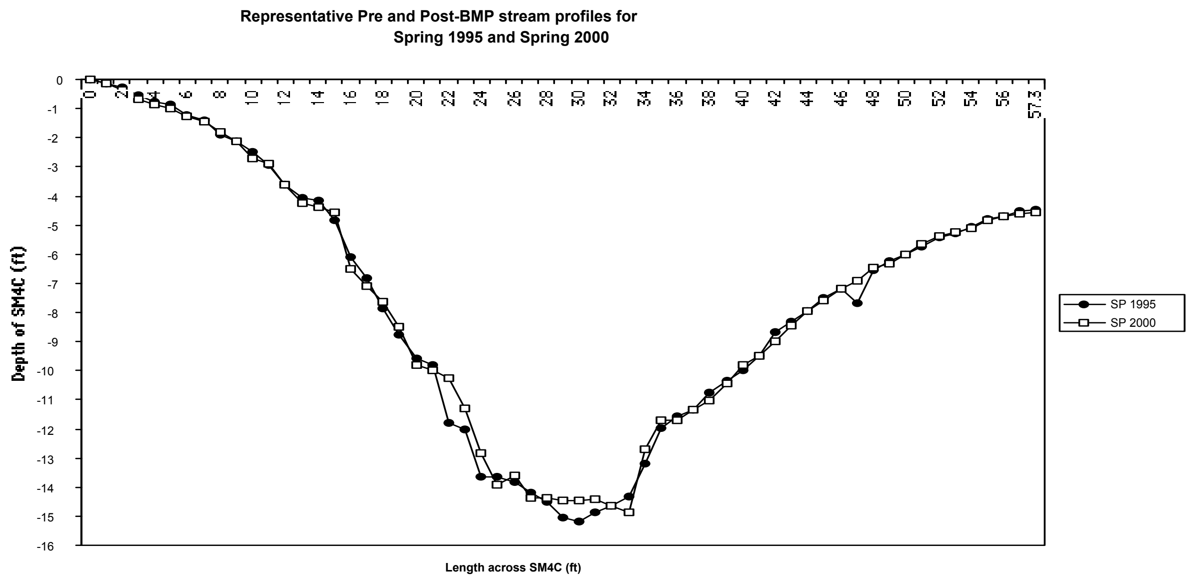

Figure 5.6. Representative pre- and post-BMP stream profiles of stream transect SM4C, Maino Ranch, Spring 1995 and 2000.
Horizontal scale is shown at top of transect, vertical scale on left; both are in feet. Vertical exaggeration is approximately 2x.

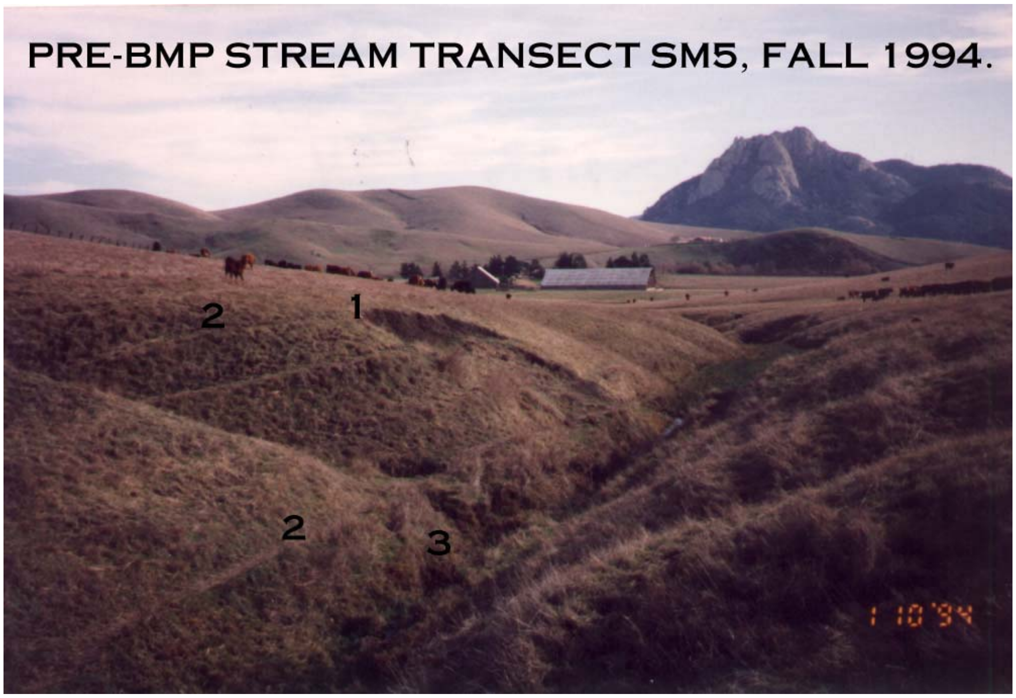

Figure 5.7. Photographs of stream transect SM5, Fall 1994 (pre-BMP) (upper) and Fall 1999 (post-BMP implementation) (lower).
Explanation of features: 1, large streambank slump scar is vegetating and stabilizing, but a new, smaller scar has formed next to it. 2, old cattle trails are vegetating, but new cattle trails have been created. 3, vegetation on stream banks and on the channel bottom appears unchanged.

Water Quality Monitoring

The small subwatershed draining to the water quality monitoring site on the Maino property was once farmed as cropland. The area is now used as rangeland, and is included in the managed grazing system. Results found at MNO are shown (along with results from CSL discussed below) in Figure 5.9. As shown, turbidity levels were variable, with elevated turbidity levels associated with winter period storm events, and lower levels associated with the dry season.

A small tributary on Camp San Luis (CSL) was also monitored independently as part of the NMP project. NMP Project Staff evaluated turbidity data collected at CSL, as a “positive control” to provide a comparison to MNO. Results found at CSL were similar to those collected at MNO (Figure 5.8), indicating that turbidity levels at MNO is similar to those found at another location that also has undergone BMPs implementation.

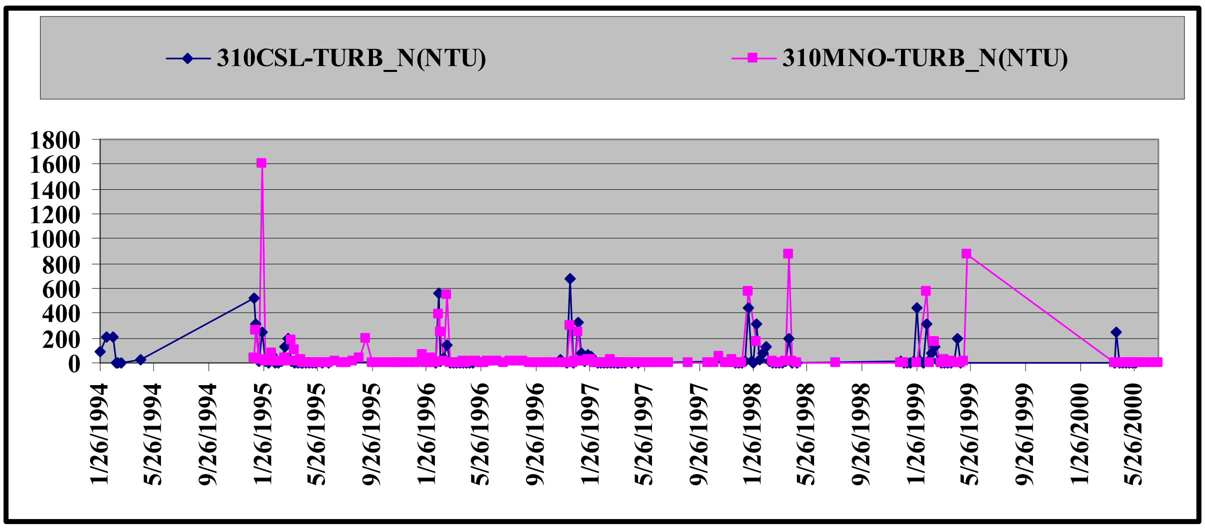

Figure 5.8. Turbidity measured from 1994 to 2000 at MNO and CSL.

Water quality changes due to BMP implementation are difficult to assess as sampling did not occur prior to implementing the managed grazing system and a “control watershed” was not established as part of the initial study design. Nonetheless, changes in water quality over time do not appear, but reductions are expected in the future as the rangeland responds to the BMPs.

5.4 Overall Conclusions

Rangeland monitoring has not shown substantial improvement in foliar or nonfoliar cover. Vegetation trends and patterns detected by the sampling appear to be more associated with natural phenomena such as soil properties or rainfall. Other trends may be artifacts of sampling time (for example, sampling a pasture before grazing one year and after grazing the following year). Ratings of channel stability did not change dramatically over the 7 years of the study, and ranged from high fair to high good on most transects. Particularly good ratings were associated with above-average rainfall and resultant vegetation density on streambanks. Water quality monitoring did not change substantially during the course of the project.

It is important to note observations that have been made by the land owner, John Maino. These include an increase in diversity and in perennials following the implementation of BMPs (Maino, pers. comm. 2001).

One of the most important findings of any long-term projects are the lessons that can be learned and transferred to future projects. One difficulty with monitoring was the high turnover rate of rangeland monitors, most of whom were student assistants, and inconsistent sampling times. Monitors expressed frustration with the lack of consistency in identifying vegetation to species, and the subjectivity of the Pfankuch method. Lack of a control (in reference to treatment) watershed was also seen as a hindrance, particularly in identifying variability of data arising from variations in rainfall. The sensitivity of cattle to unintentional disturbance by data collectors resulted in limited access of the data collectors to the ranch. This led to irregular and inconsistent sampling schedules with respect to season and grazing times. Nonetheless, this project was not initially designed to be a “study” at the time that BMPs were implemented, and instead was an opportunity to evaluate trends on a privately owned ranch.